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Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system

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Abstract

Although the benefits of e-learning have been discussed in various previous studies; it is a critical issue of better understanding the reasons why some learners are dissatisfied with the e-learning experience. Therefore, this research investigates learners' satisfaction, behavioral intentions, and the effectiveness of the Blackboard e-learning system. A total of 424 university students were surveyed using a standard questionnaire. The results showed that perceived self-efficacy is a critical factor that influences learners' satisfaction with the Blackboard e-learning system. Perceived usefulness and perceived satisfaction both contribute to the learners' behavioral intention to use the e-learning system. Furthermore, e-learning effectiveness can be influenced by multimedia instruction, interactive learning activities, and e-learning system quality. This research proposes a conceptual model for understanding learners' satisfaction, behavioral intention, and effectiveness of using the e-learning system.

Keywords: E-leaning; Satisfaction; Intention; Effectiveness; The Blackboard; TAM; 3-TUM

1. Introduction

In essence, e-learning is the most recent evolution of distance learning—a learning situation where instructors and learners are separated by distance, time, or both (Raab, Ellis, & Abdon, 2002). E-learning uses network technologies to create, foster, deliver, and facilitate learning, anytime and anywhere. The benefits of e-learning have been discussed in many articles (Bouhnik & Marcus, 2006; Liaw, Huang, & Chen, 2007; Raab et al., 2002; Shotsberger, 2000). Bouhnik and Marcus (2006) stated that e-learning has four advantages:

- Freedom to decide when each online lesson will be learned.
- Lack of dependence on the time constraints of the lecturer.

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- Freedom to express thoughts, and ask questions, without limitations.
- The accessibility to the course's online materials at students' own election.

Furthermore, Capper (2001) listed the e-learning benefits as:

- Any time: A participant can access the learning program at any time that is convenient.
- Any place: The participants do not have to meet.
- Asynchronous interaction: Interactions can be more succinct and discussion can stay more on-track.
- Group collaboration: Electronic messaging creates new opportunities for groups to work together by creating shared electronic conversations and discussions.
- New educational approaches: Many new options and learning strategies become economically feasible through online courses. Online courses also can provide unique opportunities for teachers and learners to share innovations in their own works with the immediate support of electronic groups.

Despite the perceived benefits of e-learning mentioned above, and notwithstanding the growth of the e-learning market in recent years, research indicates that a high rate of students who commence e-learning courses do not finish them (Dutton & Perry, 2002). This suggests that something is not working properly in e-learning systems. By considering the responses of students who participated in e-learning courses, it is possible to better understand the reasons why students are often dissatisfied with the e-learning experience. Bouhnik and Marcus (2006) stated that students' e-learning dissatisfaction was based the following disadvantages:

- Lack of a firm framework to encourage students to learn.
- A high level of self-discipline or self-direct is required.
- Absence of a learning atmosphere in e-learning systems.
- The distance-learning format minimizes the level of contact, as well as the level of discussion, among students. In other words, e-learning lacks interpersonal and direct interaction among students and teachers.
- The learning process is less efficient. When compared to the face-to-face learning format, e-learning requires students to dedicate more time to learn the subject matter.

Some researchers have attempted to identify particular student characteristics or other factors that can be used to predict whether a student might drop out of, or otherwise fail to achieve satisfactory results in an e-learning course (Bouhnik & Marcus, 2006). Characteristics and other circumstances identified in previous studies, including clarity of design, interaction with instructors, and active discussion in the context of the course (Swan, 2001), will enhance students' satisfaction toward e-learning.

Understanding learners' attitudes toward e-learning is a critical issue for improving e-learning usage and effects. Therefore, this research investigates learners' attitudes toward e-learning to understand how to improve e-learning satisfaction, behavioral intention, and to enhance learning effectiveness. In this study, we use the Blackboard as our e-learning system.

2. Literature review

Liaw and Huang (2007) suggested that four elements should be considered when developing e-learning environments: environmental characteristics, environmental satisfaction, learning activities, and learners' characteristics. Fig. 1 shows the elements of a Web-based collaborative e-learning environment.

In e-learning environments, environmental characteristics, such as synchronous or asynchronous interaction, will create a high-level communicative environment that allows learners not only to share information, but also to determine how to retrieve useful information. Additionally, environmental satisfaction will enhance learners' perceptions of technology that might promote their participation in the learning processes. Moreover, learning activities in e-learning provide a great chance for learners and instructors to share their knowledge and experience. In essence, when users feel less self-confident toward information technology, they also show less positive feelings toward the technology.

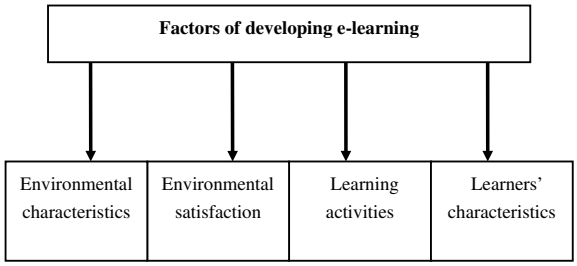

Fig. 1. Factors of developing e-learning.

For designing effective e-learning systems, Liaw (2004) suggested three considerations: learner characteristics, instructional structure, and interaction. In developing e-learning, it is necessary to understand the targeted population. First, learner characteristics, such as self-efficacy, self-directed behavior, and autonomy need to be identified (Passerini & Granger, 2000). Multimedia instruction enables learners to develop complex cognitive skills, such as understanding important elements of conceptual complexity, ability to use acquired concepts for reasoning and inference, and competence to apply conceptual knowledge to novel situations with flexibility (Spiro, Feltovich, Jacobson, & Coulson, 1995). According to interaction, when learners increase their interaction with instructors and learners, they in turn raise their chances of building their own knowledge because much of learning inevitably takes place within a social context, and the process includes the mutual construction of understanding (Liaw et al., 2007). Thus, based on fundamental e-learning criteria, these are three considerations in designing effective e-learning environments: learners' self-efficacy, multimedia formats, and interaction environments. Fig. 2 presents considerations when facilitating effective e-learning.

Understanding users' attitudes toward e-learning facilitates the creation of appropriate e-learning environments for teaching and learning. Essentially, methods of assessing e-learning cannot be evaluated using a single linear methodology. In other words, there is a need to build a multidisciplinary approach to survey individual attitudes toward e-learning (Liaw, 2002, 2007; Wang, 2003). The measurement of e-learning must incorporate different aspects of user perceptions to form a useful diagnostic instrument (Wang, 2003).

The 3-TUM (three-tier Technology Use Model) (Fig. 3) integrates multidisciplinary perspectives that included motivation, social cognitive theory (SCT), theory of planned behavior (TPB), and technology acceptance model (TAM) (Liaw, 2007). Based on the 3-TUM, individual attitudes toward information technology can be divided three different tiers: the individual characteristics (or experience) and system quality tier, the affective and cognitive tier, and the behavioral intention tier. The individual characteristics and system quality tier sets out to evaluate how individual characteristics and system quality affect individual affective and cognitive components. The affective and cognitive tier investigates how affective and cognitive components influence individual behavioral intentions. And the behavioral intention tier is to understand how the 3-TUM can predict individual behavioral intention to use technology for a particular purpose (Liaw, 2007).

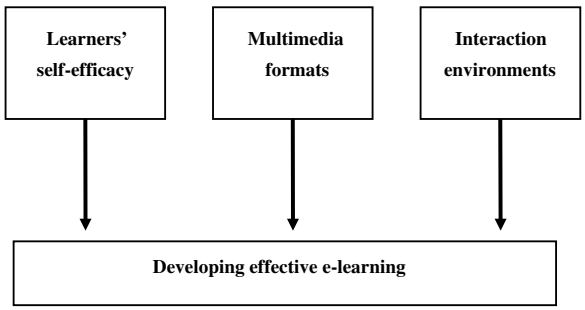

Fig. 2. Considerations for developing effective e-learning.

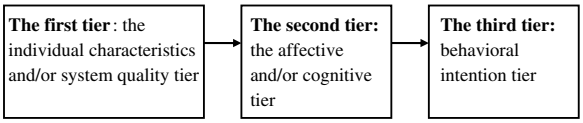

Fig. 3. The three-tier Use Model (3-TUM) (From Liaw (2007)).

3. The major functions of e-learning

In this research, we conducted an experiment study using the Blackboard as our e-leaning system. The major functions of the system include: blackboard homepage, teaching/learning materials, discussion board, quiz, homework assignment, and link.

The blackboard homepage provides overall course information (as shown in Fig. 4). It includes the syllabus, the textbook's information, assessment, and other information related the course. Teaching/learning materials (as shown in Fig. 5), in the form of PowerPoint slides, MS Word, Acrobat PDF documents, and video files can be presented through Blackboard to allow for anytime, anywhere access for students. The Discussion Board is a very useful tool for both instructors and students. The instructors can post instructions on how to prepare for an upcoming lecture, while the students can post any queries they have regarding the subject, from questions about assignments, to technical problems with the website. Responses from their peers, instructors, or technical staff can help to promptly clarify students' problems. It should be noted that while students may work off-campus, the discussion board and chat-room offer an ideal opportunity to maintain up-to-date and regular communication with instructors and peers from remote sites.

Short quizzes in the form of multiple choice questions are made available online for students who are keen to self-test their knowledge or learning. These can be presented with the use of the Blackboard function. Students, therefore, receive immediate feedback on whether their answers are correct, and what the correct response should be for each question. Instructors can also provide homework assignments online allowing students to upload their assignment files before the deadline. Another major advantage of the website is that relevant Internet links can be provided for easy access by students. As these links are regularly updated, this is a

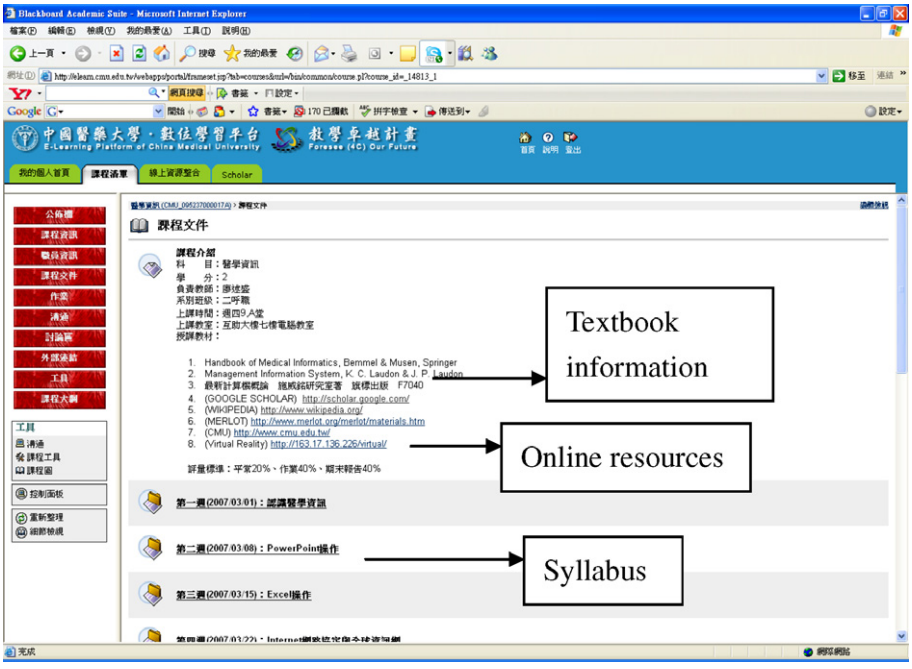

Fig. 4. Overall course information.

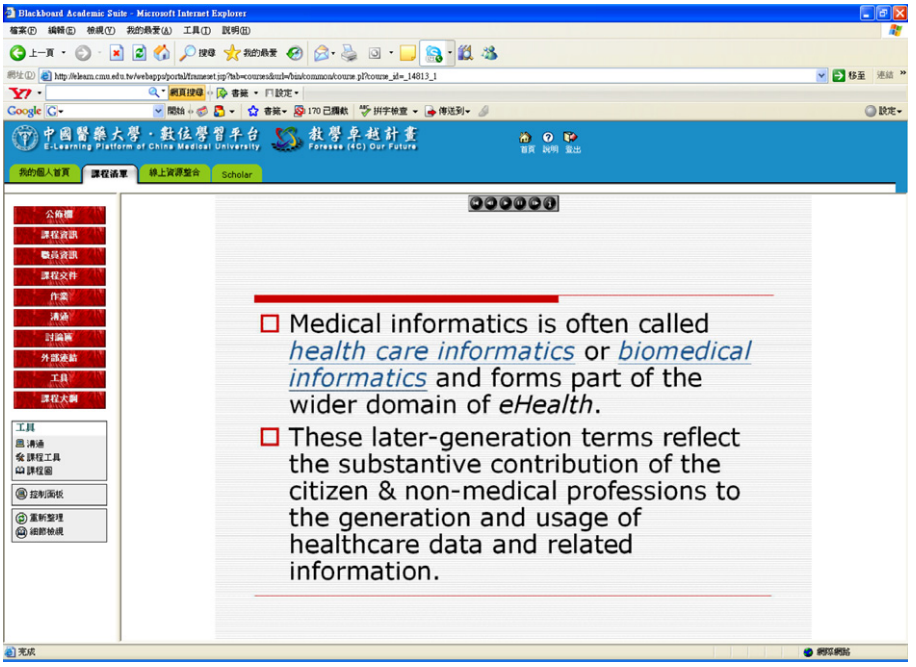

Fig. 5. The teaching/learning multimedia materials.

useful way for the tutor to provide constantly updated subject materials. It also facilitates the acquisition of knowledge by students and instructors.

4. Research hypotheses

Based on the results from the study by Liaw and Huang (2007), four elements should be considered when facilitating e-learning system; these include environmental characteristics, environmental satisfaction, learning activities, and learners' characteristics. In this study, the environmental characteristics comprise e-learning's system quality and multimedia instruction; learning activities include interactive learning activities; learners' characteristics are focused on learners' self-efficacy; and environmental satisfaction is based on e-learning environmental satisfaction. Furthermore, from the 3-TUM concept, learners' characteristics and system quality will positively affect the learners' affective and cognitive components.

The following are the hypotheses of this study:

H1: E-learning satisfaction will be influenced by the quality of the e-learning system, multimedia instruction, interactive learning activities, and learners' self-efficacy.

Based on 3-TUM concept, affective and cognitive components influence individual behavioral intention. In this research, affective and cognitive components include e-learning satisfaction and e-learning usefulness. Thus, we propose the two hypotheses.

H2a: E-learning usefulness will be influenced by the quality of the e-learning system, multimedia instruction, interactive learning activities, and learners' self-efficacy.
H2b: E-learning users' behavioral intention will be affected by e-learning satisfaction and e-learning usefulness.

One of the assumptions proposed by constructivist theory is that learning activities in which learners play active roles will engage and motivate students' learning more effectively than learning activities where learners

are passive. Individuals are assumed to learn better when they discover things by themselves and when they control the pace of learning (Leidner & Jarvenpaa, 1995). Therefore, it is natural to expect that self-directed, interactive learning would improve learning outcome. Many constructivists call for richer learning environments that contrast with the typical, less interactive classroom environments relying on instructors, textbooks, and lectures (Zhang, Zhou, Briggs, & Nunamaker, 2006). Graphics, video, and other media can help engaging learners and making them more interested (Brandt, 1997). A constructivist e-learning system should thus enable learners to engage in interactive communication, self-directed activities, and multimedia learning materials during knowledge construction.

Cognitive information processing theory is an extension of the constructivist model, based on a model of memory. It proposes processes and structures through which an individual receives and stores information and focuses on cognitive processes during learning; these involve processing instructional input to develop, test, and refine mental models until they are sufficiently elaborated upon and reliable to be effective in novel problem-solving situations (Zhang et al., 2006). A major assumption of the cognitive learning model is that a learner's attention is limited and therefore selective. With more interactive and richer media available, a learner who prefers a self-directed and interactive learning style has more flexibility to meet individual needs. Based on this, we assume that an instructional method that provides a greater variety of interactions and richer media should be more effective.

In an e-learning environment, students and instructors are physically separated. Based on activity theory, increased student engagement can improve learning outcome, such as promoting problem solving and critical thinking skills (Liaw et al., 2007). Studies have suggested that learner engagement is higher with interactive communication and multimedia instruction: higher interactivity can lead to higher learner engagement and better learning outcome (Northrup, 2001).

Therefore, we hypothesize that interactive learning activities, multimedia instruction, and e-learning system quality will positively influence e-learning effectiveness.

H3: E-learning effectiveness can be influenced by interactive learning activities, multimedia instruction, and e-learning system quality.

5. Methodology

5.1. Participants

In this research, the Blackboard e-learning system was conducted in a university in central Taiwan. The university had approximately 7700 students during the spring semester 2007. In March 2007, around 5000 freshmen, sophomore, and junior students use the Blackboard system as their primary assisted leaning tools.

This study conducts a survey to understand learner attitudes toward e-learning. The questionnaire was distributed randomly to 560 university students. After using the Blackboard e-learning system for two months, participants were asked to complete the questionnaire that included demographic information and two different components (e-learning experience, and attitudes toward e-learning). The questionnaires, including a cover letter, were distributed to participants during class. All subjects were asked to respond to the questionnaire and their responses were guaranteed confidentiality. All 560 students answered the questionnaire. Missing responses were found on questionnaires from 136 students. Therefore, of this study group comprised 424 students.

5.2. Measurement

The data for this study were gathered by means of a paper-and-pencil survey. The following shows the content of the questionnaire.

Demographic information: The demographic component covered gender and the field of study.

E-learning experience: In this component, participants were asked to indicate whether they had experience using the Internet and e-learning. These two questions were answered using all 7-point Likert scale (ranging from 1 which means "no experience" to 7 which means "well experienced").

Attitudes toward e-learning: Participants were asked to indicate their attitudes toward e-learning. These 26 questions were answered using a 7-point Likert scales (ranging from 1 which means "strongly disagree" to 7 which means "strongly agree").

6. Results

The e-learning experience is presented in Table 1. The internal consistency of reliability was assessed by computing Cronbach's αs. The alpha reliability was highly accepted ($\alpha = 0.97$) and items' coefficients are presented in Table 2. The values ranged from 0.57 to 0.80. Given the exploratory nature of the study, reliability of the scales was deemed adequate.

The Pearson correlation coefficients among the variables were presented in Table 3. The bi-variate relationships indicated that most of the variables were significantly correlated with each other and that the correlations were all less than 0.80.

The stepwise multiple regression results for the path associated with the variables are presented in Table 4. To test H1, a regression analysis was performed to check the effect of e-learning system quality, multimedia instruction, interactive learning activities, and perceived self-efficacy on perceived satisfaction. The results revealed that three independent variables (perceived self-efficacy, multimedia instruction, and e-learning system quality) were predictors of learners' perceived satisfaction ($F(3,420) = 263.86$, $p = 0.000$, $R^2 = 0.651$). Perceived self-efficacy was the biggest contributor (50.5%). To test H2a, a regression analysis was performed to check the effect of e-learning system quality, multimedia instruction, interactive learning activities, and perceived self-efficacy on perceived usefulness. The results revealed that four independent variables were predictors of learners' perceived satisfaction ($F(4,419) = 165.72$, $p = 0.000$, $R^2 = 0.613$). Multimedia instruction was the biggest contributor (47.9%). To examine H2b, a regression analysis was performed to check the effect of perceived satisfaction and perceived usefulness on learners' behavioral intention to use e-learning. The results showed that both factors (perceived usefulness and perceived satisfaction) were predictors of learners' behavioral intention to use e-learning ($F(2,421) = 344.36$, $p = 0.000$, $R^2 = 0.619$). The perceived usefulness was the biggest contributing factor (58%). To evaluate H3, a regression analysis was performed to check the effect of interactive learning activities, multimedia instruction, and e-learning system quality on e-learning effectiveness. The results showed that these three independent factors were predictors of e-learning effectiveness ($F(3,420) = 301.82$, $p = 0.000$, $R^2 = 0.681$). Multimedia was the biggest predictor and it had 59.3% contribution on e-learning effectiveness.

7. Discussion

Based on the descriptive information in Table 1, although students were highly experienced Internet users ($M = 6.09$), they did not have much e-learning experience ($M = 3.48$). This result demonstrates a message that e-learning is a potential assisted learning tool for learners. In other words, school-based e-learning is still a potential market for universities.

Table 2 reveals information that students only have a middle level positive attitudes toward e-learning usage, from perceived usefulness ($M = 4.30$) to interactive learning activities ($M = 3.93$). It seems that although learners believe that e-learning is a useful assisted learning tool, they are concern with system quality, especially interactivity. While using the Blackboard e-learning system, learners indicated that they needed more interactive and communicative functions and activities.

From the Table 4, the most critical factor that positively affected learners' satisfaction toward e-learning was perceived self-efficacy of using e-learning. The result indicates that learners' self-efficacy is an important

Table 1
Descriptive statistics of e-learning experience

Variables	*M*	SD
Experience using the Internet	6.09	1.16
Experience with e-learning	3.48	1.68

Table 2
The Mean, standard deviation, item-total correlations (from 1 which means "strongly disagree" to 7 which means "strongly agree")

Items	*M*	SD	r^*
Perceived self-efficacy:	4.24	1.39	
I feel confident using the e-leaning system (the Blackboard)	4.25	1.49	0.72
I feel confident operating e-learning functions	4.23	1.43	0.71
I feel confident using online learning contents	4.23	1.44	0.72
Perceived satisfaction:	3.95	1.26	
I am satisfied with using e-learning as a learning assisted tool	3.90	1.44	0.767
I am satisfied with using e-learning functions	3.87	1.38	0.77
I am satisfied with learning contents	3.95	1.35	0.77
I am satisfied with multimedia instruction	4.08	1.37	0.79
Perceived usefulness:	4.30	1.30	
I believe e-learning contents are informative	4.33	1.46	0.78
I believe e-learning is a useful learning tool	4.27	1.36	0.77
I believe e-learning contents are useful	4.30	1.41	0.79
Behavioral intention:	4.10	1.18	
I intend to use e-learning to assist my learning	4.14	1.40	0.80
I intend to use e-learning content to assist my learning	4.13	1.39	0.78
I intend to use e-learning as an autonomous learning tool	4.04	1.28	0.61
e-learning system quality:	3.93	1.14	
I am satisfied with e-learning functions	3.85	1.43	0.66
I am satisfied the Internet speed	4.04	1.43	0.57
I am satisfied with e-learning content	3.94	1.24	0.78
I am satisfied with e-learning interaction	3.90	1.28	0.76
Interactive learning activities:	3.90	1.22	
I would like to share my e-learning experience	3.82	1.42	0.70
I believe e-learning can assist teacher-learner interaction	3.97	1.39	0.72
I believe e-learning can assist learner-learner interaction	3.91	1.33	0.74
E-learning effectiveness:	4.07	1.27	
I believe e-learning can assist learning efficiency	4.11	1.38	0.76
I believe e-learning can assist learning performance	4.06	1.36	0.75
I believe e-learning can assist learning motivation	4.04	1.38	0.75
Multimedia instruction:	4.19	1.25	
I like to use voice media instruction	4.14	1.39	0.74
I like to use video media instruction	4.23	1.37	0.73
I like to use multimedia instruction	4.18	1.36	0.77

r^*: corrected item-total correlation.

Table 3
Correlation analyses

Variables	2	3	4	5	6	7	8
1. Perceived self-efficacy	0.71*	0.64*	0.62*	0.55*	0.57*	0.52*	0.56*
2. Perceived satisfaction		0.78*	0.72*	0.67*	0.64*	0.60*	0.67*
3. Perceived usefulness			0.76*	0.65*	0.64*	0.65*	0.69*
4. Behavioral intention				0.74*	0.67*	0.70*	0.70*
5. E-learning system quality					0.70*	0.64*	0.67*
6. Interactive learning activities						0.76*	0.71*
7. E-learning effectiveness							0.77*
8. Multimedia instruction							

* $p < 0.01$.

factor that influences e-learning usage. Additionally, e-learning system quality and multimedia instruction were significant predictors of perceived satisfaction with e-learning. In other words, system and multimedia quality seem to enhance learners' positive attitudes toward e-learning. Although interactive learning activities

Table 4
Regression results of predicted path relationships

H*	Dependent variable	Independent variables	β	R^2	p
H1	Perceived satisfaction	Perceived self-efficacy	0.42	0.505	<0.001
		E-learning system quality	0.27	0.112	<0.001
		Multimedia instruction	0.26	0.034	<0.001
H2a	Perceived usefulness	Multimedia instruction	0.32	0.479	<0.001
		Perceived self-efficacy	0.29	0.094	<0.001
		E-learning system quality	0.21	0.033	<0.001
		Interactive learning activities	0.10	0.003	0.036
H2b	Behavioral intention	Perceived usefulness	0.51	0.580	<0.001
		Perceived satisfaction	0.32	0.039	<0.001
H3	E-learning effectiveness	Multimedia instruction	0.45	0.593	<0.001
		Interactive learning activities	0.38	0.086	<0.001
		E-learning system quality	0.08	0.002	0.043

H* – hypothesis.

was not a predictive factor, the correlation between interactive learning activities and perceived satisfaction was significantly high ($r = 0.64$). Regarding perceived usefulness, system and multimedia quality were the biggest predictors which enhanced e-learning usefulness; moreover, learners' self-efficacy, system quality, and interactive learning activities were also key factors that influenced e-learning usefulness.

Table 4 demonstrates that perceived satisfaction and usefulness correlates with more behavioral intention among learners. Multimedia instruction, interactive learning activities, and e-learning system quality are all critical predictors of e-learning effectiveness. This indicates that varied multimedia learning content is a crucial for improving e-learning efficacy, performance, and motivation among users.

8. Conclusion

Based on the case study of the Blackboard, we propose a conceptual model for investigating satisfaction, behavioral intention, and e-learning effectiveness among users (Fig. 6). Fig. 6 shows that learners' characteristics will influence learners' perceived satisfaction, and perceived usefulness of a product. The conceptual model also shows that environmental characteristics will affect perceived satisfaction, perceived usefulness and e-learning effectiveness. The perceived satisfaction and perceived usefulness will positively affect learners'

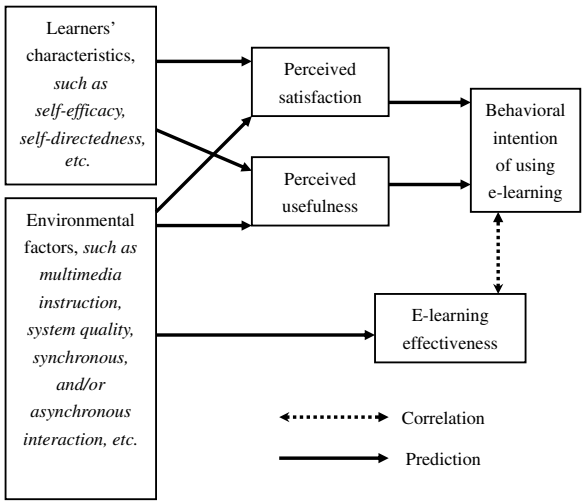

Fig. 6. A conceptual model of user' satisfaction, behavioral intention, and effectiveness toward e-learning.

behavioral intention of e-learning usage. Furthermore, there was a significantly high correlation ($r = 0.70$) between learners' behavioral intention participate in e-learning and e-learning effectiveness.

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